Treatment and Follow Up Outcomes of Patients with Peroneal Nerve Injury: A Single Center Experience

Peroneal Sinir Hasarlı Hastaların Tedavi ve Takip Sonuçları;Tek Merkezli Deneyim

Treatment of the Patients with Peroneal Nerve Injury

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Özet

Amaç: Tuzak nöropati, vücudun bölgeleri arasındaki geçiş noktaları fibröz kemik kanalları içinde, periferik sinir sıkışması ile karakterizedir. Peroneal sinir, alt ekstremitelerin travmatik yaralanmalarında en sık yaralanan sinirdir. Sunulan çalışmada, hasardan sonra kliniğimize geç başvuran peroneal sinir yaralanmaları olan hastaların cerrahi tedavisinin fonksiyonel sonuçları araştırılmıştır, ayrıca teşhis üzerindeki bu gecikmenin etkilerinin gözlemlenmesi amaçlanmıştır. EMG' li hastaların ve fiziksel inceleme bulgularının postoperatif sonuçları yorumlandı. Gereç ve Yöntem: Sunulan çalışmaya 2012- 2015 yılları arasında kliniğimize başvuran peroneal sinir hasarlı hastalar dâhil edildi. Klinik değerlendirme için pre ve postoperatif olarak EMG ve kas motor gücü testleri gerçekleştirildi. Bulgular: Çalışma popülasyonundaki 16 hastanın 7' si erkek ve 9' u kadındı. Ortalama yaşları 49.6 (14-77 yaş arası). Hastalar sinir hasarından yaklaşık 9 ay sonra kliniğe başvurdu. Peroneal sinir hasarının nedenleri 4 hastada (% 25) protez cerrahisi, 2 hastada diz hasarı (% 12.5), 4 hastada (% 25) tarım işçilerinin aşırı çömelmesi, 2 hastada (% 12.5) agresif egzersiz, 2 hastada (% 12.5) kemik kırığı iken 2 hastada (% 12.5) ise nedeni belli değildi. Tartışma: Peroneal sinir yaralanması genellikle, fibulanın baş veya boyun bölgesindeki sinir sıkışmasıyla meydana gelmektedir. Dekompresyon cerrahisinin sonuçları genellikle non-travmatik sinir palsileri ile uyumludur. Yaralanma ve teşhis arasındaki geçen süre ve kas atrofisi tedavinin başarısı ile ilişkili ana faktörlerdir.

Anahtar Kelimeler

Peroneal Sinir; Kas Gücü; EMG; Cerrahi

Abstract

Aim: Trap neuropathy is characterized by compression of the peripheral nerve into fibro osseous channels in trespassing areas of body segments. Peroneal nerve is the most frequently injured nerve in traumatic injuries of the lower extremities. In the present study, we investigated functional results of surgical treatment of patients with peroneal nerve injury who delayed visiting our clinics after the damage; we also aimed to observe the effects of this delay on prognosis. We interpreted postoperative results of the patients with EMG and physical examination findings. Material and Method: Subjects with peroneal nerve damage who visited our clinics between 2012 and 2015 were included in the present study. EMG and muscle motor strength tests were conducted pre and postoperatively for clinical assessment. Results: Of the 16 patients in the study population, 7 were men and 9 were women. The median age of the subjects was 49.6 years (14-77 years). Admission time was 9 months after injury. Causes of the peroneal nerve damage were as follows: prosthesis surgery in 4 (25%), ankle damage in 2 (12.5%), excessive squatting by agriculture workers in 4 (25%), aggressive exercise in 2 (12.5%), bone fracture in 2 (12.5%), and unknown origin in 2 (12.5%). Discussion: Peroneal nerve injury usually occurs by compression of the nerve at the head or neck of the fibula. Results of decompression surgery are usually compromising in non-traumatic nerve palsies. Period of duration between injury and diagnosis and muscular atrophy are main factors associated with success of treatment.

Keywords

Peroneal Nerve Injury; Muscle Strength; EMG; Surgery

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Introduction

Trap neuropathy is characterized by compression of the peripheral nerve into fibro osseous channels in trespassing areas of body segments [1-4]. Knowledge of peripheral nerve anatomy is essential for understanding the pathophysiology of trap neuropathies. It is suspected that several peripheral nerves could be impacted by factors such as superficial location, a narrow pathway, or proximity of a joint, leading to chronic compression and trap neuropathy [5]. Prognosis of peripheral nerve damage varies depending on etiology and underlying mechanisms [6]. Because trap neuropathy is less common in the lower extremities, misdiagnosis is a challenge [1-4]. Peripheral nerves consist of axons, schwannoma cells, vascular structures, myelin layers, fibrocytes, epineurium, perineurium, and endoneurium. The mechanism of the injury should be well established for a better understanding of nerve damage. For this purpose, a detailed history and physical examination are crucial. Spontaneous healing of peripheral nerve injury could be obtained within 3-6 months and a full recovery may occur within the first two years [7]. Nerve damage can be treated by surgical or by non-surgical approaches. Timing of the surgery depends on the location and nature of the injury.

The common peroneal nerve originates from the sciatic nerve at popliteal fossa and then divides into two major branches, superficial and deeper branches, at the fibular head and fibular channel level. This nerve is the most frequently injured nerve in traumatic injuries of the lower extremities. Due to its superficial location at the fibular head level, injuries most often occur at that location. Patients with long term immobility and those with disturbances of consciousness are at risk for peroneal nerve injury. Bone fractures, lacerations, and obstruction by sutures after surgery may damage the nerve. Fractures of the proximal fibular, dislocation of the knee, tibial osteotomies, arthropathy of the knee and hip, and arthroscopy procedures may induce injury to the peroneal nerve. Peroneal nerve palsy is the most common nerve injury that occurs following total knee arthroplasty. Incidence of peroneal injury is reported as 0.3-3% in the literature. It is more common in patients with rheumatoid arthritis, genu valgus, and prior root disorders. Knee involvement in rheumatoid arthritis is about 90% and bilateral involvement is seen in 70%. Trap neuropathy may occur in athletes due to muscular hypertrophy which results in leg pain during exercise. Weight loss may also induce external compression of the peroneal nerve because of the thinning of the adipose tissue around the head of fibula. Normal delivery may cause nerve compression at knee level, induced by squatting for a long time positionally [8]. Leg elongation procedures, anorexia nervosa, and paraneoplastic syndromes are rare causes of peroneal nerve injury. Hyperthyroidism, diabetes mellitus, vasculitis syndromes, leprae, and rheumatoid arthritis also may induce nerve injury [9-11].

The most common symptom is difficulty walking due to weakness of the foot dorsiflexor muscles. Pain is not considered to be a common symptom of peroneal nerve damage. Foot drop may occur without pain. Characteristic walking disability is so called as stepage walking. Patients raise their feet in an exaggerated fashion while walking to avoid falling.. Over-flexion in the knee and hip joints occurs and patients cannot perform a heel strike. Eversion of the foot may be intact and plantar flexion is usually not affected. Tinnel test is positive. Sensory loss occurs in the anterodistal segment of the leg and the dorsal face of the foot [9,11]. The most useful diagnostic test is EMG. Open surgical decompression may cure 87% of the patients who are unresponsive to conservative therapy.

In the present study, we investigated functional results of the surgical treatment of patients with peroneal nerve injury who delayed visiting our clinics in after nerve damage; we also aimed to observe the effects of delayed treatment on prognosis. We interpreted pre and postoperative results of the patients with EMG and physical examination findings.

Material and Method

A total of 16 subjects with peroneal nerve damage who visited our clinics between 2012 and 2015 were included in the present study. Complaint at admission was dorsiflexion difficulty of the foot; all were diagnosed with peroneal nerve injury. Surgical treatment was applied for all subjects after diagnoses established. The time between nerve damage in the study subjects and the surgery was 6 to 36 months. EMG and muscle motor strength tests were conducted pre and postoperatively to determine their clinical situation. Pre and postoperative motor strength scores of the participants were evaluated based on the British Medical Research Council scale (Table 1).

Table 1. British Medical Research Council Muscle Motor Strength Evaluation Scale.

Stage	Evaluation
M0	No contraction
M1	Trace of contraction
M2	Active movement with gravity eliminated
M3	Active movement against gravity
M4	Active movement against gravity and resistance
M5	Normal muscular strength

EMG tests were performed by the same neurologists in the pre and postoperative periods by a Nihon Kohden MEB-9104K EMG device. All patients were treated surgically between tests. Surgery included microsurgical peroneal nerve decompression and neurolysis techniques under local anesthesia. Follow-up was performed at the 1st, 6th, and 12th month after surgery. In the meantime, clinical evaluation and EMG tests were conducted for each subject. Median follow-up duration was 11 months (6-16 months).

Results

Of 16 patients in the present study population, 7 were men and 9 were women. The median age of the subjects was 49.6 years (14-77 years). Admission time was 9 months after injury. Causes of the peroneal nerve damage were as follows: prosthesis surgery in 4, ankle sprain in 2, excessive squatting of agriculture workers in 4, aggressive exercise in 2, bone fracture in 2, and unknown origin in 2 (Table 2).

None of the present patients encountered any complications after surgical treatment. Target muscle groups had varying degrees of atrophy which resolved in those patients who had undergone surgery within 12 months of nerve damage. Muscu-

Table 2. Diagnosis of patients with peroneal nerve injury.

Diagnosis	n	%
Squatting agriculture worker	4	25
After prosthesis surgery	4	25
Ankle sprain	2	12.5
Non-traumatic	2	12.5
Bone fracture	2	12.5
After aggressive exercise	2	12.5

lar atrophy was not completely resolved in those subjects who had undergone surgery more than 12 months after nerve injury. Improvements in clinical and EMG findings were better in those patients who were treated before development of muscular atrophy.

Discussion

Compression, or trap neuropathy, is defined as internal or external compression of peripheral nerves at their anatomic tracing. Compression and traction are both important in the pathophysiology of the trap neuropathies. They both induce ischemia in the nerves and cause conduction blockage. The clinical Picture occur specifically to compressed nerve. Severity of the nerve damage is associated with amplitude and duration of the traction or compression. High pressure causes anoxic injury in the peripheral nerves. However, even pressures as low as 20-30mmHg may induce intraneuronal ischemia. Prolonged ischemia and compression lead to protein devastation and demyelination. Irreversible fibrosis follows demyelination [12]. Therefore, timing of the surgical decompression is very critical in the treatment of peroneal nerve injuries.

The peroneal nerve is located superficially in a 4 cm area of the head and neck of the fibula. Thus, damage to the nerve by trauma or by other reasons may occur at that location. Tall and lean body, knee prosthesis, prolonged crouching, and incorrect positioning during surgery may cause injury to the peroneal nerve [13]. In our series, four patients had peroneal nerve damage that followed knee prosthesis operations.Besides superficial pathway of the nerve, extreme mobility of the fibula head may also induce mechanical trauma [14].

Inversion sprain of the ankle is a common injury of the lower extremities. Rarely, it may be associated with peroneal nerve damage [15]. Two of our patients had previous ankle sprains.

A study in the literature reported excellent results of surgical treatment of subjects with non-traumatic peroneal nerve injury located at the fibula head level [16]. We reported two cases of peroneal injury due to non-traumatic reasons who presented with foot drop. Muscular strength was 2/5 and 3/5 preoperatively and reached 4/5 at the 7th and 5/5 at the 30th postoperative day.

Another patient in the present study had peroneal damage due to a fracture 3 years before surgery. Preoperatively, in addition to 0/5 muscle strength, foot drop, leg pain, and numbness were noted. Pain and numbness resolved during the postoperative period; however, muscle strength of the foot dorsiflexes were still 0/5 and ankle inversion muscle strength only rose to 2/5. No additional clinical or EMG improvements were noted in this patient at the 3rd and 6th month follow-ups.

Conclusion

Peroneal nerve injury usually occurs by compression of the nerve at the head or neck of the fibula. Preoperative findings consisted of partial or complete axonal damage, under the knee defect in superficial peroneal sensitive responses in various degrees, partial or dense denervation in needle EMG, postoperative EMG was consisted with measured muscle strength and prominent resolve in drop foot, increase in motor unit axion potential and even complete resolution in conduction findinges. Results of the decompression surgery are usually compromising in non-traumatic nerve palsies. The period of duration between injury and surgery and muscular atrophy are the main factors associated with treatment success.

Competing interests

The authors declare that they have no competing interests.

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